

7-08 GENERAL PIPE INSTALLATION REQUIREMENTS**7-08.1 Description**

This Work includes installing culverts, storm sewers, and sanitary sewers. The Contractor shall also follow Section [7-02](#), [7-04](#), or [7-17](#) as it applies to the specific kind of Work.

7-08.2 Materials

Gravel Backfill for Foundations [9-03.12\(1\)](#)

Gravel Backfill for Pipe Zone Bedding [9-03.12\(3\)](#)

7-08.3 Construction Requirements**7-08.3(1) Excavation and Preparation of Trench****7-08.3(1)A Trenches**

The length of trench excavation in advance of pipe laying shall be kept to a minimum. Excavations shall either be closed up at the end of the day or protected per [Section 1-07.23\(1\)](#).

The trench width shall be as specified in [Section 2-09.4](#) and shall be excavated to the depth and grade as staked by the Engineer.

Trenches must be of sufficient width in the pipe zone to permit proper installation and bedding of the pipe and to provide the required compaction of backfill. Above the top of the pipe zone, the Contractor may excavate to any width.

All ledgerrock, boulders, and stones shall be removed to provide a minimum of 6-inches clearance under all portions of the pipe.

Placement of bedding material shall precede the installation of all pipe. This shall include necessary leveling of the native trench bottom or the top of the foundation material as well as placement and compaction of required bedding material to a uniform grade so that the entire length of pipe will be supported on a uniformly dense unyielding foundation.

When, after excavating to the foundation level, the material remaining in the trench bottom is determined to be unsuitable by the Engineer, excavation shall be continued to such additional depth and width as required by the Engineer. Unsuitable foundation materials shall be disposed of at an approved site. The trench foundation shall be backfilled to the bottom of the pipe zone with gravel backfill for foundations, gravel backfill for pipe zone bedding, or other suitable material, and compacted to form a uniformly dense, unyielding foundation.

All material excavated from trenches and piled adjacent to the trench shall be maintained so that the toe of the slope is at least 2-feet from the edge of the trench. It shall be piled to cause a minimum of inconvenience to public travel, and provision shall be made for merging traffic where necessary. Free access shall be provided to all fire hydrants, water valves, and meters; and clearance shall be left to enable free flow of storm water in gutters, conduits, or natural watercourses.

If any part of the excavated material meets the Specifications of [Section 9-03.12\(3\)](#), the Engineer may require that such material, in the quantity required, be selectively removed, stockpiled separately, and used as pipe bedding instead of quantities of gravel backfill for pipe zone bedding. If material so stockpiled becomes contaminated, the Contractor shall furnish suitable material in an amount equal to that lost by contamination

at no expense to the Contracting Agency. All costs involved in storing, protecting, re-handling, and placing the material shall be included in other items of Work on the project.

Excavation for manholes and other Structures connected to the pipelines shall be sufficient to provide a minimum of 12-inches between their surfaces and the sides of the excavation.

The Contractor shall furnish, install, and operate all necessary equipment to keep excavations above the foundation level free from water during construction, and shall dewater and dispose of the water so as not to cause injury to public or private property or nuisance to the public. Sufficient pumping equipment in good working condition shall be available at all times for all emergencies, including power outage, and shall have available at all times competent workers for the operation of the pumping equipment.

Where pipe is to be placed in a new embankment, the embankment shall be constructed as shown in the Plans or as designated by the Engineer for a distance each side of the pipe location of not less than 5 times the diameter and to a minimum height equal to $\frac{1}{2}$ of the outside diameter of the pipe. The embankment material shall be compacted to 95-percent density and the moisture content at the time of compaction shall be between optimum and 3-percentage points below optimum as determined by the Compaction Control Tests specified in Section 2-03.3(14)D. The trench shall then be excavated to a width as specified in 2-09.4, and the pipe installed in accordance with the Standard Plan.

7-08.3(1)B Shoring

The Contractor shall provide all materials, labor, and equipment necessary to shore trenches to protect the Work, existing property, utilities, pavement, etc., and to provide safe working conditions in the trench. The Contractor may elect to use any combination of shoring and overbreak, tunneling, boring, sliding trench shield, or other method of accomplishing the Work consistent with applicable local, State, or Federal safety codes.

If workers enter any trench or other excavation 4-feet or more in depth that does not meet the open pit requirements of [Section 2-09.3\(3\)B](#), it shall be shored. The Contractor alone shall be responsible for worker safety, and the Contracting Agency assumes no responsibility.

Upon completing the Work, the Contractor shall remove all shoring unless the Plans or the Engineer direct otherwise.

Shoring to be removed, or moveable trench shields or boxes, shall be located at least $2\frac{1}{2}$ pipe diameters away from metal or thermoplastic pipe if the bottom of the shoring, shield, or box extends below the top of the pipe, unless a satisfactory means of reconsolidating the bedding or side support material disturbed by shoring removal can be demonstrated.

Damages resulting from improper shoring or failure to shore shall be the sole responsibility of the Contractor.

7-08.3(1)C Bedding the Pipe

Pipe zone bedding material shall provide uniform support along the entire pipe barrel, without load concentration at joint collars or bells. All adjustment to line and grade shall be made by scraping away or filling in with bedding material under the body of the pipe and not by blocking or wedging. Bedding disturbed by pipe movement, or by removal of shoring movement of a trench shield or box, shall be reconsolidated prior to backfill.

Pipe zone bedding shall be as specified in the Standard Plan and shall be placed in loose layers and compacted to 90-percent maximum density. Bedding shall be placed, spread, and compacted before the pipe is installed so that the pipe is uniformly supported along the barrel. Lifts of not more than 6-inches in thickness shall be placed and compacted along the sides of the pipe to the height shown in the Standard Plan. Material shall be worked carefully under the pipe haunches and then compacted.

If the Engineer determines that the material existing in the bottom of the trench is satisfactory for bedding the pipe, the bedding material specified in the Standard Plan is not required, provided the existing material is loosened, regraded, and compacted to form a dense, unyielding base.

7-08.3(2) Laying Pipe

7-08.3(2)A Survey Line and Grade

Survey line and grade control hubs will be placed in a manner consistent with accepted practices.

The Contractor shall transfer line and grade into the trench where they shall be carried by means of a laser beam or taut grade line supported on firmly set batter boards at intervals of not more than 30-feet. Not less than 3 batter boards shall be in use at 1 time. Grades shall be constantly checked and in the event the batter boards do not line up, the Work shall be immediately stopped, the Engineer notified, and the cause remedied before proceeding with the Work. Any other procedure shall have the written approval of the Engineer.

7-08.3(2)B Pipe Laying — General

After an accurate grade line has been established, the pipe shall be laid in conformity with the established line and grade in the properly dewatered trench. Mud, silt, gravel, and other foreign material shall be kept out of the pipe and off the jointing surfaces.

All pipe laid in the trench to the specified line and grade shall be kept in longitudinal compression until the backfill has been compacted to the crown of the pipe. All pipe shall be laid to conform to the prescribed line and grade shown in the plans, within the limits that follow.

Pipe shall be laid to a true line and grade at the invert of the pipe and the Contractor shall exercise care in matching pipe joints for concentricity and compatibility. In no case shall 2 pipes be joined together with ends having the maximum manufacturer's tolerance. The invert line may vary from the true line and grade within the limits stated to develop uniformity, concentricity, and uniform compression of jointing material provided such variance does not result in a reverse sloping invert. The limit of the variance at the invert shall not exceed plus or minus 0.03-feet at the time of backfill. Checking of the invert elevation of the pipe may be made by calculations from measurements on the top of the pipe.

The pipe, unless otherwise approved by the Engineer, shall be laid up grade from point of connection on the existing pipe or from a designated starting point. The pipe shall be installed with the bell end forward or upgrade. When pipe laying is not in progress, the forward end of the pipe shall be kept tightly closed with an approved temporary plug.

Where pipe joints must be deflected within the manufacturer's recommended limits to accommodate required horizontal or vertical curvature, it shall first be joined in straight alignment and then deflected as required.

Where pipe joints must be deflected to an amount greater than the manufacturer's recommended limits to accommodate required horizontal or vertical curvature, the curves shall be achieved with a series of tangents and shop fabricated bends, subject to the approval of the Engineer.

Upon final acceptance of the Work, all pipe and appurtenances shall be open, clean, and free draining.

7-08.3(2)C Pipe Laying — Concrete

For concrete pipe with elliptical reinforcement, the markings indicating the minor axis of the reinforcement shall be placed in a vertical plane (top or bottom) when the pipe is laid.

7-08.3(2)D Pipe Laying — Steel or Aluminum

Pipe with riveted or resistance spot welded seams shall be laid in the trench with the outside laps of circumferential joints upgrade and with longitudinal laps positioned other than in the invert, and firmly joined together with approved bands.

Aluminum pipe or pipe arch used in concrete shall be painted with 2 coats of paint. The aluminum pipe to be painted shall be cleaned with solvent to remove contaminants. After cleaning, the pipe shall be painted with 2 coats of paint conforming to Federal Specification TT-P-645 (primer, paint, zinc chromate, alkyd vehicle). Aluminized steel pipe will not require painting when placed in Controlled Density Fill (CDF) or when in contact concrete head walls.

All costs of cleaning and painting the aluminum surfaces as specified shall be included in the unit Contract price per linear foot for the aluminum pipe or pipe arch.

7-08.3(2)E Rubber Gasketed Joints

In laying pipe with rubber gaskets, the pipe shall be handled carefully to avoid knocking the gasket out of position or contaminating it with foreign material. Any gasket so disturbed shall be removed, cleaned, relubricated if required, and replaced before joining the sections.

The pipe shall be properly aligned before joints are forced home. Sufficient pressure shall be applied in making the joint to ensure that the joint is home, as defined in the standard installation instructions provided by the pipe manufacturer. The Contractor may use any method acceptable to the Engineer for pulling the pipe together, except that driving or ramming by hand or machinery will not be permitted. Any pipe damaged during joining and joint tightening shall be removed and replaced at no expense to the Contracting Agency.

Care shall be taken to properly align the pipe before joints are entirely forced home. During insertion of the tongue or spigot, the pipe shall be partially supported by hand, sling or crane to minimize unequal lateral pressure on the gasket and to maintain concentricity until the gasket is properly positioned. Since most gasketed joints tend to creep apart when the end of the pipe is deflected and straightened, such movement shall be held to a minimum once the joint is home.

Sufficient restraint shall be applied to the line to ensure that joints once home are held so by compacting backfill material under and alongside the pipe or by other acceptable means. At the end of the work day, the last pipe shall be blocked in such a manner as may be required to prevent creep.

7-08.3(2)F Plugs and Connections

Plugs for pipe branches, stubs, or other open ends which are not to be immediately connected shall be made of an approved material and shall be secured in a place with a joint comparable to the main line joint, or stoppers may be of an integrally cast breakout design.

7-08.3(2)G Jointing of Dissimilar Pipe

Dissimilar pipe shall be jointed by use of a factory-fabricated adapter coupling or a pipe collar as detailed in the Standard Plans.

7-08.3(2)H Sewer Line Connections

Storm and sanitary sewer line connections to trunks, mains, laterals, or side sewers shall be left uncovered until after the Engineer has inspected and approved the Work. After approval of the connection, the trench shall be backfilled as specified.

7-08.3(2)I Side Sewer Connections

Where a storm or sanitary side sewer is larger than the trunk, main, or lateral to which it is to be connected, the connection shall be made only at a standard manhole unless otherwise provided in the Plans or in the Special Provisions, or unless otherwise authorized by the Engineer.

7-08.3(3) Backfilling

Placement of pipe zone backfill shall be performed in accordance with these requirements and the Standard Plan. Trenches shall be backfilled as soon after the pipe laying as possible.

Pipe zone backfill material shall be clean earth or sand, free from clay, frozen lumps, roots, or moisture in excess of that permitting required compaction. Rocks or lumps larger than 3-inches maximum shall not be used for pipe zone backfill.

Pipe zone backfill shall be placed in loose layers and compacted to 90-percent maximum density. Backfill shall be brought up simultaneously on each side of the pipe to the top of the pipe zone. The pipe shall then be covered to the top of the pipe zone and the materials compacted in a manner to avoid damaging or disturbing the completed pipe.

Backfill above the pipe zone shall be accomplished in such a manner that the pipe will not be shifted out of position nor damaged by impact or overloading. If pipe is being placed in a new embankment, backfill above the pipe zone shall be placed in accordance with Section 2-03.3(14)C. If pipe is being placed under existing paved areas, or Roadways, backfill above the pipe zone shall be placed in horizontal layers no more than 6-inches thick and compacted to 95-percent maximum density. If pipe is being placed in non-traffic areas, backfill above the pipe zone shall be placed in horizontal layers no more than 6-inches thick and shall be compacted to 85-percent maximum density. All compaction shall be in accordance with the Compaction Control Test of Section 2-03.3(14)D. Material excavated from the trench shall be used for backfill above the pipe zone, except that organic material, frozen lumps, wood, rocks, or pavement chunks larger than 6-inches in maximum dimension shall not be used. Materials determined by the Engineer to be unsuitable for backfill at the time of excavation shall be removed and replaced with imported backfill material.

Backfilling of trenches in the vicinity of catch basins, manholes, or other appurtenances will not be permitted until the cement in the masonry has become thoroughly hardened.

When it is required that a blanket of select material or bank run gravel is to be placed on top of the native backfill, the backfill shall be placed to the elevations shown in the Plans, or to the elevations specified by the Engineer. Compaction of the native material shall be as required by the Contracting Agency and shall be performed prior to placing the select material. Surface material shall be loosened to whatever depth is required to prevent bridging of the top layer, but shall in no case be less than 18-inches.

The Contractor shall not operate tractors or other heavy equipment over the top of the pipe until the backfill has reached a height of 2-feet above the top of the pipe.

7-08.3(4) Plugging Existing Pipe

Where shown in the Plans or where designated by the Engineer, existing pipes shall be plugged on the inlet end for a distance of 2 diameters with commercial concrete. Care shall be used in placing the concrete in the pipe to see that the opening of the pipe is completely filled and thoroughly plugged.

7-08.4 Measurement

Gravel backfill for foundations, or gravel backfill for pipe zone bedding when used for foundations, shall be measured by the cubic yard, including haul, as specified in [2-09](#).

There will be no specific unit of measure for any material placed in the pipe zone in the installation of culvert, storm sewer, and sanitary sewer pipes.

Plugging pipes will be measured per each, for each plug installed, for pipe diameters up to and including 36-inches. The concrete for plugging pipes in excess of 36-inches in diameter will be measured by the cubic yard. Computations for corrugated metal pipes will be based on the nominal diameter.

Excavation of the trench will be measured as Structure excavation Class B or Structure excavation Class B including haul, by the cubic yard as specified in [Section 2-09](#). When excavation below grade is necessary, excavation will be measured to the limits ordered by the Engineer.

Embankment construction before pipe placement under the applicable provisions of [Section 7-08.3\(1\)A](#) will be measured in accordance with [Section 2-03](#).

Shoring or extra excavation class B will be measured as specified in [Section 2-09.4](#).

7-08.5 Payment

Payment will be made in accordance with [Section 1-04.1](#) for each of the following Bid items that are included in the Proposal:

“Gravel Backfill for Foundations Class ____”, per cubic yard.

“Gravel Backfill for Pipe Zone Bedding”, per cubic yard.

All costs associated with furnishing and installing bedding and backfill material within the pipe zone in the installation of culvert, storm sewer, and sanitary sewer pipes shall be included in the unit Contract price for the type and size of pipe installed.

“Plugging Existing Pipe”, per each.

“Commercial Concrete”, per cubic yard.

“Structure Excavation Class B”, per cubic yard.

“Structure Excavation Class B Incl. Haul”, per cubic yard.

“Shoring or Extra Excavation Class B”, per square foot.

All costs in jointing dissimilar pipe with a coupling or concrete collar shall be included in the unit Contract price per foot for the size and type of pipe being jointed.